

table 31).

The ratio of kernel types on the testcross ears of those plants in the progeny of plant 6629A-8 that were Y Spm/y+ in constitution is given in line 2 of table 31. It may be noted that the percent of recombinants in the variegated class of kernels on these ears resembles that obtained from tests of the Y Spm/y + plants in the progeny of plants 6629A-1, A-4, A-6 and A-7, discussed in the previous section and summarized in table 29. Among the plants having more than one Spm in the Y bearing chromosome, different groupings with regard to position of the Spm elements ~~in these plants~~ could be made based on the ratio of phenotypes appearing on the testcross ears produced by each ^{plant}. They fell into two main groups, as shown in lines 3 and 4 of table 31. In addition, there were two plants on whose testcross ears the ratio of kernel types did not fit that given either in line 3 or 4 of table 31. The kernel types on the ears these two plants produced are entered in lines 5 to 7 of this table.

From the tests conducted with the progeny of plant 6629A-8, it would appear that this plant had one Spm element which occupied the same position in chromosome 6 as in the four Y Spm/y + plants in culture 6629, and that although transposition of it away from this location occurs, the frequency ~~of occurrence~~ of this is not high. The second Spm element

in this plant, also located in the Y bearing chromosome, appeared to undergo more frequent transposition. This ~~often~~ resulted in placement of it usually at new locations within the Y bearing chromosome 6 and less frequently at locations that do not show linkage with Y.

Progeny Test 3, figure 2

Plant 6629A-2 obviously had more than 2 Spm elements, as the ratio of kernel types on its testcross ear, given in table 5, indicate. Kernels were selected both from the ^{of the stalk} main ear and from the ^{of the} tiller ear of this plant and sown in the summer of 1954. Only those plants derived from the colorless, sh₂ classes were examined in detail for the Spm constitution in each. Tests conducted with them established the fact that the parent plant had a high number of Spm elements in it. The ten plants derived from the colorless, sh₂, Y class of kernels on the tiller ear of this plant had the Spm constitutions given in table 32. It was not possible to establish the exact number of Spm elements in plants that obviously had at least 3 of them. More than 3 Spm elements could have been present in some of them. It was clear, nevertheless, that in several plants, 2 Spm elements were present, each of which was carried in the Y bearing chromosome 6.

In addition to these 10 plants, mentioned above, 8 other plants derived from the colorless, sh₂, y class of kernels on the tiller ear of plant 6629A-2 were also examined for Spm constitution. Three plants had

1 Spm and it was not linked with either pr or wx in any one of them.

Three other plants had 2 Spm elements. In one of these plants, one of the two Spm elements was located in its wx carrying chromosome 9. The kernel types on the testcross ear of this plant were as follows: 35 pale colored Wx, 8 pale colored wx, 47 variegated Wx, and 80 variegated wx. In each of the remaining two plants, at least 3 Spm elements were present. In one of them an Spm element appeared to be located in the wx carrying chromosome 9. On its testcross ear the following phenotypes appeared among its kernels: 21 pale colored Wx, 2 pale colored wx, 97 variegated Wx, and 117 variegated wx.

Progeny Test 4, figure 2

In order to further investigate the location of the Spm element in the Y bearing chromosome 6 in the progeny given in table 32, twenty kernels were selected from the variegated, Y class on the ear produced by plant 6667F-11, line 2, table 32, which was considered to be Y Spm Spm/y ++. They were sown the following year under culture number 6884. Nineteen of the twenty plants derived from these kernels were variegated, as expected, but one was totally pale colored and ⁱⁿ none of the kernels on the testcross ear of this plant was evidence given of the presence of Spm. Testcross ears were obtained from 17 of the 19 variegated plants. They

fell into four groups with regard to Spm constitutions, as shown in table 33. Three plants were $Y\ Spm/y +$. On the testcross ears of two of them, the ratio of kernel types, line 1, table 33, was quite similar to that on testcross ears produced by the $Y\ Spm/y +$ plants in table 30 and by the majority of their $Y\ Spm/y +$ progeny, already discussed. On the testcross ear of one plant, however, the ratio of kernel types suggested that the Spm in it was carried in the Y bearing chromosome but at a position closer to Y than in the two $Y\ Spm/y +$ sister plants (line 2, table 33). Twelve other plants were $^Y\ Spm\ Spm/y + +$ in constitution (line 3, table 33). The two remaining plants had an Spm in the Y bearing chromosome and in addition, another Spm element not linked with Y (line 4, table 33).

From the ear of the main stalk of plant 6629A-2 (see table 5), only those plant that were derived from the colorless, sh_2, y class of kernels were examined for the Spm constitution in each. These were grown under culture number 6668C. Among the nine plants tested in culture 6668C, two had no Spm. Three plants had 1 Spm and in one of them, plant 6668C-6, this Spm was linked with pr in chromosome 5, as shown in line 1 of table 34. On this ear, accurate classification for the alleles of Lr and pr was not possible for all kernels in the pale (no Spm) class and therefore, both pale phenotypes are combined under the heading of " L pale". In the four

remaining plants, 2 Spm elements were present and they were not linked with each other. In one of them, one of the Spm elements was linked with pr in chromosome 5. The phenotypes of kernels on the testcross ear were as follows: 96 pale colored (both Pr and pr included), 97 variegated, Pr, and 145 variegated, pr. In another of the plants having 2 Spm elements, plant 6668C-3, one of these elements was linked with wx. The kernel types on its testcross ear are given in line 1 of table 35. Subsequent tests conducted with the variegated kernels on this ear will be considered shortly.

Progeny Test 5, figure 2

In order to investigate further the location of Spm in plant 6668C-6 (line 1, table 34), and the stability of it at this location, ten kernels were selected from the variegated, Pr (recombinant) class of kernels on the ear it produced and these were sown in the summer of 1955 under culture number 6877. Nine of the 10 plants derived from these kernels were variegated. One, however, was totally pale pigmented. As will be shown later, an Spm element was present in this plant but it was in its inactive state. Testcross ears were obtained from 6 of the 9 variegated plants in culture 6877. An Spm was present in each but in only 3 of them was it linked with Pr in chromosome 5. The Spm in the other three plants gave no

evidence of linkage with Pr. The types of kernels on the testcross ears produced by each of these 6 plants are given in table 34. Among the 3 plants carrying Spm in chromosome 5, the position of it within this chromosome does not appear to be the same. Certainly, its location in plant 6877-4 differs from that in either plant 6877-1 or plant 6877-2.

It should be emphasized that the kernels selected from the ear of plant 6668C-6 were in a recombinant class. The recombinant classes arise from two distinctly different events. One is typical crossing over between homologues. The Spm is transferred from one homologue to the other without its undergoing change in location. The second event is premeiotic transposition of Spm which places it at another location in the chromosome complement. Subsequent meiotic segregation may result in its inclusion in a nucleus having the allele of the marker to which it was formerly linked. As a general rule, within the recombinant class, increasingly higher proportions of kernels having a transposed Spm element will ~~be~~ ^{appear} present the closer is Spm to the genic marker.

Progeny Test 6, figure 2

As mentioned above, plant 6668C-3 carried two Spm elements, one of which was linked with wx in chromosome 9, as shown in line 1 of table 35. It was desired to obtain plants in which the only Spm present was carried in ch

kernel types on the testcross ears each produced indicated, table 35.

Three plants had ^{linked} 2/Spm elements but no evidence was given of linkage of them with either Pr or Wx. One plant had 2 Spm elements, not linked to one another nor to Pr or Wx. One plant had at least 3 Spm elements.

There were so few pale colored kernels on the testcross ear of this plant that ~~evidence of~~ ^{of an Spm element} linkage with either Pr or Wx could not be ~~estimated~~ ^{determined}.

The testcross ear produced by another plant had only ^{very} a small basal sector in which variegated kernels appeared. All other kernels on this ear were uniformly pale colored, the phenotype produced by a_1^{m-1} when no Spm is present.

A total of 40 ears were obtained from the testcrosses conducted with the variegated plants in culture 6872, just described. Five ears had sectors in them in which all kernels were pale colored (no Spm) and they appeared only on ears of plants in which 1 Spm was present. The rate of appearance of such pale sectors was considerably higher than had been observed on testcross ears produced by ^{plants} ~~having~~ ^{in which the} 1 Spm ^{in culture} carried in ~~the~~ ^{that were} ~~Y-bearing~~ chromosome 6 discussed previously. On the ears of these latter plants pale sectors appeared only very infrequently. Obviously, ^{then,} the Spm element in some of the plants of culture 6872 was undergoing change ~~at a~~ ^{early in} ~~different time during~~ development and this was evident on the ear produced by one of the plants in which it was located in chromosome 9. It was

in chromosome 9. Therefore, 30 kernels were selected from the variegated Wx class on the ear of plant 6668C-3 and grown in the summer of 1954 under culture number 6872. Twenty-nine of the 30 plants derived from ~~these kernels~~ these kernels were variegated but one was uniformly pale pigmented and none of the kernels on the testcross ear it produced gave evidence of the presence of Spm in this plant. Testcross ears were obtained from 27 of the 29 variegated plants. It could be concluded that in 19 of these 27 plants, 1 Spm was present but it was not linked with Wx nor with Pr. Three other plants had only 1 Spm and in each it was linked with Wx in chromosome 9, as the

132 by which
therefore decided to investigate further the behavior of the Spm that was located in chromosome 9.

Progeny Test 7, figure 2

The kernel types on the testcross ears produced by the three plants in culture 6872 in which Spm was located in chromosome 9 are entered in table 35. As may be noted, the percent of the recombinant classes ~~varied~~ ^{varied} and in plant 6872A-12, a decided difference was expressed ^{on} ~~between that given by~~ the ear of the main stalk and that of its tiller. ^{on} It appeared that the Spm element in plant 6872A-12 ^{had} ~~was~~ undergoing change in location early in development. ^{then} ~~For this reason,~~ it was decided to test the behavior of ~~the~~ Spm ^{the progeny of this plant.} ~~in it in~~ subsequent generation. Therefore, kernels were selected from the variegated, Wx class on the ear of the main stalk of this plant and sown under culture number 7285 in the summer of 1956. Thirteen plants were obtained from these kernels. Twelve of them were variegated but one was totally pale pigmented, and no evidence of the presence of Spm was obtained from test crosses conducted with it. Since the purpose of this experiment was to determine Spm number and location in different parts of the same plant, all fertile ears produced by each plant were used in the test cross. ^{not having Spm but which were} Pollen from plants homozygous for state 5718 ^{and} ~~a₁~~ and for the recessives, pr, y, and wx, was placed on the silks of each ear of ^{each} ~~each~~ plant. Altogether, 26 ears were obtained from the 12 plants having Spm. The Spm constitution and location with respect

Wx is summarized in table 36. In one plant, no evidence was given of linkage of Spm with Wx in any one of the four tested parts of this plant (plant A-7, table 36). Spm was lined with Wx in some part of the other 11 plants but not in all tested parts of each plant. It was obvious that the Spm in these plants was undergoing change in location in somatic cells and that the time of occurrence of this was early in development. For those parts of these plants in which one Spm was present and carried in the Wx bearing chromosome 9, the kernel types on each ear which gave evidence of this is shown in table 37. From the ratio of types on these ears, it could be suspected that the Spm did not occupy the same position in chromosome 9 in all ~~plants~~ or even in different parts of the same plant. The kernel types appearing on each of the 9 other ears obtained from the plants in which Spm was present are given in summary form in table 38.

Progeny Tests 8, 10, 11, and 13, figure 2

The early occurring transposition of Spm in plants in culture 7285 was so strikingly expressed that it was decided to continue investigation of its behavior in plants of the following generation. For this purpose, variegated kernels in the Wx class were selected from the four ears indicated by footnotes in table 37, and these were sown under the

given culture numbers in the summer of 1957. Thirty seven plants were obtained from them. Thirty-six~~4~~ of these plants were variegated. One, however, was totally pale colored and no evidence of Spm appeared among the kernels on the testcross ear it produced. All fertile ears of each plant were used for the testcross. The Spm constitution in the tested parts of these plants is summarized in table 39. Again, in this generation, early occurring transposition of Spm was noted. The phenotypes of kernels on ears produced by those parts of a plant that had ^{one} Spm, carried in the Wx bearing chromosome 9, are entered in table 40, and a summary of all others is given in table 41.

The behavior of the isolate of Spm that was present in the plants just described, was consistent with respect to time of occurrence of transposition. It was occurring in some cells early in plant development. Other isolates of Spm differ in this respect and, as mentioned above, early occurring transposition of it in the Y Spm/y + plants, previously described, was infrequent. Among 40 Y Spm/y + plants in which more than one part of a plant was tested, for Spm constitution, only 1 case of change in Spm was noted and this was produced by inactivation of it rather than by its transposition. The Spm at the given location in

in chromosome 6 does undergo transposition, however, but the time of occurrence of this was usually late in plant development rather than early in development.

The frequency of occurrence of transposition at any one time appears to differ with different isolates of Spm. For some of them, this is quite infrequent in that only rarely is a case of transposition detected either in the plant or in the gametes it produces. With some other isolates, on the other hand, a burst of transpositions occurs in sporogenous or spore cells. As a consequence, a large fraction of the Spm carrying gametes of such plants have a newly transposed Spm in them. But, before examples of this are discussed, another experiment of small scope, conducted with the Spm element that was present in plants of culture 7285 (tables 36 to 39), will be described.

Progeny Test 9, figure 2

The plants in culture 7330 (table 40) were derived from variegated, Wx kernels on the second ear of the main stalk of plant 7285A-1 (table 37). The Spm in this part of the plant was carried in its Wx bearing chromosome 9. In the tiller of this plant, one Spm element was present but on the testcross ear it produced, no evidence was given of linkage of it with Wx. It was desired to examine the Spm constitution

in different parts of plants derived from variegated Wx kernels on this tiller ear in order to determine if ^{ih}any of them linkage of ^{Spm}~~Wx~~ with Wx would be found. Eleven plants, all of which were variegated, were grown from such kernels under culture number 7331. (See line 1, table 42 for the kernel types on the ear from which these kernels were selected.) Testcrosses were made with all fertile ears of each of these 11 plants. Only one ear was obtained from 5 plants and one Spm, not linked with Wx, was present in the part of each plant that produced an ear. Another plant produced 4 fertile ears. One Spm was present in the four tested parts of this plant and in no part was it linked with Wx. The kernel types on the ears these 6 plants produced are entered in line 2 of table 42. Some part of each of the five other plants in culture 7331 had more than one Spm element in it, as shown in lines 3 to 8 of table 42. One of the tillers of plant 7331B-5, however, had only one Spm in it.

Except for the ear of one tiller of plant 5, the ratios of kernel types on ears produced by different parts of each plant in culture 7331 that had more than one Spm element in it were very much alike. Differences in this respect were expressed between plants, however. The number of plants tested and the number of tests conducted with each plant are too few to draw definite conclusions regarding the behavior of this Spm following its transposition in a somatic cell of plant 7285A-1 from a position in chromosome 9, giving linkage with Wx, to a new location in the chromosome complement. It is evident, nevertheless, that subsequent transposition of it occurred ~~but the rate of early occurring transpositions appeared to be reduced.~~ ~~It is also evident that in none of the plants in~~ *but in no case did this result in its* culture 7331 did a transposition return ~~it~~ to a position in chromosome 9 that showed linkage with Wx.

Program Test 14, figure 2

That transposition of Spm from ^{one} ~~location~~ ~~xxxxxxxxxxxxxxxxxxxx~~ *may* ~~result~~ to a new location ~~will~~ result in marked change in time and frequency of occurrence of ^{subsequent} ~~transposition~~ ^{of it} was strikingly expressed in one case.

In part II of this report, tests conducted with the progeny of the Y Spm / y + plants of culture 6629A were considered, ~~in detail~~. There it was pointed out that the ^{ratio of} kernel types on each of ^{the} two test cross ears produced by plant 6666C-7 in the progeny of plant 6629A-1 ~~was~~ quite aberrant, and

~~It~~ ^{agree} did not ~~conform~~ ^{that appearing on} with ~~these~~ ^{cross ears obtained from} obtained from tests of the majority of plants in this progeny (see parts ~~I and II~~ of table 26). It was decided, therefore, to examine some of the progeny one ^{are} that ear/entered in ~~part II~~ of table 26. Two variegated kernels in the \bar{Y} class on this ear and 3 variegated kernels in the y class were grown under culture numbers 6895A and 6895B in the summer of 1955. Tests of the Spm constitution of each of the five plants derived from them gave surprising results. One Spm was present in plant 6895A-1 and it was closely linked to Y. On the test cross ear of this plant there were 167 pale colored kernels of which 10 were Y and 157 were y, and 162 variegated kernels of which 153 were Y and 9 were y. In addition, there was a small sector in which only pale colored kernels appeared; 21 kernels in this sector were Y and 26 were y.

Plant 6895A-2 had 2 Spm elements, one of which was carried in its Y bearing chromosome 6. In addition to one kernel ^{the} ~~having~~ ^{on the ear which had} a mutant of a_1^{m-1} , there were 91 pale colored kernels of which 39 were Y and 107 were y, and 234 variegated kernels of which 130 were Y and 107 were y. No linkage of ~~the Spm~~ ^{the} with ^{Pr} or ^{Wx} was given.

^{linkage of} ~~the Spm~~ ^{the second Spm element}

Plant 6895B-1 ^{which was y14} apparently had one Spm, and it was not linked to either Pr or Wx. On its testcross ear there was one kernel with a mutant of a_1^{m-1} . Among the other kernels, 119 were pale colored and 133 were variegated.

Plant 6895B-2 had one Spm element and it was linked with Pr in chromosome 5. Among the kernels on the testcross ear it produced the following phenotypes appeared: 74 pale colored, Pr₁: 154 pale colored, pr : 131 variegated, Pr : 71 variegated pr.

Plant 6895B-3 had one Spm element and it was linked with Wx. Among the kernels on the test cross ear it produced the following phenotypes appeared: 91 pale colored, Wx : 184 pale colored, wx : 117 variegated, Wx : 75 variegated wx.

Although ~~the Spm constitution was determined~~ ^{plants derived from it} in only 5 plants in the ~~were examined~~ progeny of plant 6666C-7¹/₂, the difference ^{Spm} in ~~the~~ constitution and location ^{among them} of ~~it~~ in each plant was ^{remarkable} striking. Both testcross ears produced by the parent plant were partially sterile in that some ovules did not produce kernels and others produced kernels that were abortive in their development. Also, on both ears, the percentage of kernels having Spm was low. On none of the ears of the 5 progeny plants was sterility expressed, ^{also,} and a noticeable reduction in proportion of kernels having Spm was exhibited only ^{the degree} by plant 6895B-3 and this did not approach that given by the ears of the parent plant. Obviously, there must have been either a burst of transpositions of Spm in ^{parent} this plant, most of which occurred late in development, or a succession of such transpositions, leading to the formation

of gametes in which Spm occupied various different location in the
^{in many of them}
 chromosome complement.

Progeny Test 15, Figure 2

Progeny tests were conducted with plants derived from the variegated
 kernels on the ears produced by plants 6895A-1, in which Spm was closely
^{with 7261}
 linked with Y, and by plant 6895B-3 in which Spm was linked with Wx.

~~They showed that~~ ^{in these two plants}
~~With regard to the subsequent behavior of Spm, these progeny tests~~
~~was~~
 gave strikingly different results. The Spm in plant 6895A-1 ~~proved to be~~ ^{was}
~~relatively stable in location~~ ^{to close to Y in chromosome 6, in chromosome 9}
 whereas that in plant 6895B-3 underwent

many subsequent transpositions. It may be recalled that the Spm in
~~the one Spm~~ ^(was present) ~~in plant 6666C-7 was derived from that in plant 6629A-1, and that~~ ^{therefore} the Spm in
 all subsequent progeny may be considered to be ~~derived from the Spm in this~~ ^{stem} ~~one~~
~~6629A-1 plant.~~ ^{It seems evident that transposition of Spm to a new location}
~~The behavior of this Spm following transposition of it to~~
~~a new location can differ and over a wide range, with respect to subsequent~~
~~transpositions that occur.~~ ^{may result in change in its subsequent behavior and the degree of this with regard to}
^{time and frequency of occurrence of subsequent transposition may vary over a wide range.}

^{and consequently}
 element itself in that some change may occur to it ~~during~~ the transposition
^{on the other hand,}
 process. However, this control may reflect the particular organization
^{which}
 of the genetic materials at the site it occupies at any one time.

Evidence for this latter interpretation was obtained from studies of the
 Ds - Ac system. Two independently occurring cases of insertion of Ds just
 to the left of Sh_1 in chromosome 9 resulted in fixation of Ds at this

location. Although many thousands of kernels were examined in any one of which an altered location of Ds could have been detected, not one case of this was found. If there had been only one discovered case of insertion of Ds at this location, just to the left of Sh_1 , nothing could be concluded about the factors that are responsible for its stability of location. There were, however, two such cases following which Ds behaved in exactly the same manner, and this suggests that the site in the chromosome where a controlling element resides is an important factor in the control of subsequent transpositions of such ^{an} element, be it Ds, Ac, Spm, or any other of this species.

We may now return to give the evidence of the difference in behavior of Spm in plant 6895A-1 when compared ^{with} ~~to~~ ^{the other} that in plant 6895B-3. As stated above, in plant 6895A-1, the Spm element was located close to Y in chromosome 9 as the kernel types on its testcross ear indicated (part I, table 43). Seventeen plants were grown from the variegated Y class of kernels on this ear in the summer of 1956 under culture number 7260. All of the plants were variegated. The silks of each fertile ear of every plant received pollen from ^{a plant in} ~~the~~ ^{homozygous for} tester stock which was a_1^{m-1} (state 5718), y, pr, and wx and in which no Spm was present. The kernel types on the ears these plants produced are given in parts II and III of table 43.

In 14 plants the location of Spm was the same as in the parent plant^{and} in ^{as shown by the ratio of kernel types} on the ears ^{as shown by the ratio of kernel types} produced, Part II, table 43. ^{all tested parts of each plant,} ~~The kernel types appearing on each of the~~

ears these 14 plants produced ~~is given in part II of this table.~~ Only

4.5 percent of the kernels on these ears were in the "recombinant" classes.

The ratio of kernel types on ~~the~~ ^{the other} ears of three plants differed from this

in some manner, and ~~these~~ ^{is shown} are given in part III of table 43. In plant

7260-2, ^{the location} linkage of Spm ^{in the main cluster} with Y was expressed by the ^{linkage of the variegated} ~~ratio of kernel types~~ ^{class with Y and the pale class with y} appearing on the ear of the main stalk ~~although~~ ^{the ratio of the pale colored}

^{class} to the variegated class ^{deviated in favor of the pale class more on this ear} ~~was somewhat higher~~ than on the ears produced by

the sister plants, entered in part II, ^{as well he must account shortly, this} suggesting ~~either~~ ^S that the Spm in it

^{underwent} ~~was undergoing~~ more transpositions ^{in the sporophyte cell} ~~late in development~~ ^{did the Spm} than in the sister

plants. On the ear produced by the tiller of this plant, no evidence was

given of linkage of the one Spm in it with Y. On the ear obtained from

plant 7260-16, a small sector was present in which all of the kernels were

^{remainder} pale colored. On the ~~rest~~ of this ear, however, the ratio of kernel

types was the same as that on ears of the sister plants in part II of table

43. The ear produced by plant 7260-17 was partially sterile and from

the ratio of kernel types on this ear, it was clear that some abnormality in

the Spm carrying ⁴ chromosome was responsible for this sterility. The

nature of this abnormality is not known.

If no transposition of Spm occurs during development of the sporogenous or spore cells in ^aplants having one Spm, then half of the gametes it produces would ^{have} one ^{one} Spm and half would have no Spm. As a consequence, half of the kernels on the testcross ear it produces would be variegated and half would be pale colored. However, such transpositions do occur^{all} and often this results in the appearance of two Spm elements in one nucleus of a sporogenous or gametophytic cell and no Spm in its sister nucleus. Because of this, the proportion of cells with no Spm in the sporogenous or gametophytic cells will depend upon the frequency of occurrence of ^{such} transpositions, ~~that had occurred earlier in development.~~

Thus, the proportion of kernels on testcross ears that are pale colored

will increase as the rate of ^{such} ~~this~~ transposition increases, ~~and~~ many progeny tests have ^{supported} ~~indicated the correctness of~~ this interpretation ^{as a major factor that is responsible for the} of deviation from ^{a ratio of} ~~the~~ one pale-colored to one variegated kernel ^{that often appears} on testcross ears of ^{that} initially plants/having one Spm in their nuclei. Therefore, whenever the ratio of pale colored kernels to variegated kernels deviates from the ^{expected} 1 : 1 in ^{that occurred} favor of the pale class on a testcross ear of a plant having one Spm the cause for this is ^{may be suspected to be} ~~usually~~ transposition of Spm in a number of cells, late in development of ^{to} sporogenous or ^{usual} gametophytic tissues. For this ^{of the} conclusion to ^{valid} ~~apply~~, the pale colored kernels on such ears must be

scattered over the ear and not be clustered. It is obvious that the latter arises from an ^{early in development, (these can)} ~~early occurring~~ event in a single cell ^{effecting} ~~effecting~~ either transposition of Spm or ~~its~~ ^{inactivation of Spm} inactivation. On some ears, ^{rather than} ~~an~~ imbalance in the ratio of pale to variegated kernels, ~~results not from~~ transposition of ~~Spm but rather from its inactivation in some cells.~~ ^{often} ~~Usually~~ it is possible to make a ^{distinguished} ~~distinction~~ between the two types of change in Spm ^{either in its location or its action} that are responsible for the unequal ratio of the two classes of kernels on an ear. ^{How it is possible to do} ~~Why~~ this is ~~so~~ will be indicated in the ^{of this report} section/dealing with inactivation of Spm.

The tests conducted with the progeny of plant 6895A-1, described above, indicated that the Spm in it and in the majority of its progeny did not change its location during early development with any marked degree of frequency. ^{Also,} ~~as~~ the ratios of pale to variegated kernels on the testcross ears entered in part II of table 43 indicate, not many transpositions of it were occurring late in development of the sporogenous cells. However, the Spm in the sister plant, 6895B-3, underwent many transpositions and the evidence of this will now be given.

Progeny Test 161 Figure

The Spm in plant 6895B-3 was located in its Wx bearing chromosome 9, as the kernel types on its testcross ear indicated (see line 1, table 44). It may be noted that the ratio of pale colored to variegated kernels

on this ear (275 pale : 192 variegated) deviated greatly in favor of the pale class. That some of this was due to transposition of Spm was suggested by the Spm constitution in plants derived from the variegated, Wx class of kernels on this ear. The seventeen examined progeny plants were grown under culture number 7261 in the summer of 1956. Sixteen of them were variegated and one was totally pale pigmented. On the testcross ear produced by this latter plant, none of the kernels gave evidence of the presence of Spm. Twenty-nine testcross ears were obtained from the 16 variegated plant in this culture. In only 5 of them was Spm linked with Wx and then not in all parts of each plant. Many changes, both in location of Spm and in its action, must have been occurring in these plants as the kernel types on the ears they produced indicate, table 44. Also, chromosomal abnormalities may have been produced ^{in some ears} when this occurred as the deficiency in the Wx class of kernels on the tiller ear of plant 7261-5 suggests. Also, on some ears ~~the proportion of~~ the pale class of kernels greatly outnumbered ~~the~~ the variegated class. In one plant, 7261-10, an Spm element appeared to be present in the wx/^{bearing}chromosome as well as in the homologue with Wx but at a different location in the chromosome. In plant 7261-12, the Spm in it was fully active in the tiller but in the main stalk, it was inactive in a number of kernels ^{and} ~~produced by both~~

^{both} on the ~~xxxxxx~~ the first and the second ear. Among the kernels on the three ears of plant 7261-6 in which Spm was present, a few appeared in which the Spm in them was only weakly active (see section dealing with the Spm-w state of Spm). ^{Also} The majority of these kernels were in the wx class.

It is obvious that in comparison with the behavior of Spm in the progeny tests so far outlined, ^{that} ~~the Spm~~ in plant 6895B-3 was behaving in an unusually aberrant manner, not only because of the frequent transposition^s of ~~it~~ that were occurring, but also because of changes in its action that ~~to~~ ^{also because} took place, and the possible effect it had in plant 7261-6 in introducing a modified type of Spm action in the non-Spm carrying homologue with wx. Unfortunately, further progeny tests were not conducted with any one of these plants. Thus, no more was learned of the subsequent behavior of this Spm that originally was present in plant 6629A-2 but had been greatly altered in its mode of behavior in the second generation plant, 6895B-3, and ⁱⁿ some of ~~its~~ ^{of this latter plant.} progeny, in turn,

At this point in the discussion of transposition of Spm we will pause to review the evidence of this that has been given so far. For this purpose, we will confine the discussion to those that occur in plants having only 1 Spm element in them. In the first place, the appearance of these plants may be considered. ^{In} Those isolates of Spm that undergo early occurring transposition during development, the effect of this is made visible in the appearance of the plant itself for they have large sectors in them that exhibit the pale pigmented phenotype that ^{is produced} ~~arise~~ when ~~no~~ Spm is ^{absent} ~~present~~. If such a sector extends into that part of a plant that produces an ear, the presence of it may be evident ~~among~~ the kernels on the ear following the test cross conducted with it. If the ~~cells~~ that give rise to the ear are derived only from those within the pale sector, ~~otherwise~~ all of the kernels on the testcross ear will be pale pigmented. If, however, only some of the cells within the pale sector contribute to the ear, then a clearly defined sector will appear on the testcross ear in which all of the kernels will be pale pigmented. Again, if a pale sector extends into the tassel, pollen grains collected from anthers within the sector do not contain Spm in them, ^{this pollen is} ~~and when~~ used to make a test ^{m-1} ~~cross~~, all of the ^{a1} kernels on the resulting ear are pale pigmented. ~~for they do not have Spm in them.~~ If pollen ~~is~~ collected from the

the variegated parts of the same tassel is used in making a cross, then both ~~the~~ pale colored and ~~the~~ variegated kernels appear on the testcross ear. Tests of this type were conducted and they gave the types of result just described. Thus, the appearance of uniformly pale pigmented sectors in variegated plants, the number of them that appear in any one plant, and their relative sizes of them, reveal the time of occurrence of transposition of Spm during development as well as the frequency of occurrence of this at any one time. However, inactivations of Spm ^{in some cells of a plant} may produce similar patterns of pale pigmented sectors, ~~in~~ [^] ~~variegated plants~~ but often it is possible to recognize the pale pigmented sectors that arise from inactivation, as will be indicated later.

Early occurring transposition may also be detected by the difference in number of Spm elements, or in the location of an Spm element, in different parts of the same plant, and Detailed evidence of this was given in the discussion of the behavior of Spm in plant 6872A-12 and its progeny, that were examined in several successive generations (see pages ⁶⁰⁻⁶⁵ and tables 36 to 42). A high frequency of late occurring transpositions of Spm may be detected by several means: the ^{type of variegation in} ~~appearance~~ [^] of the plant, the ratio of pale to variegated kernels on its testcross ears, and the number and distribution of Spm in its progeny plants. The plant exhibits a pattern of variegation composed only of small streaks ^{anticyanin pigment} ~~exhibiting~~ in a non-pigmented background with ^{the} ~~states~~ [^] 5719A-1 and 5718 of a ^{stocks} A_1^{m-1} that were extensively used in studies of transposition of Spm. These [^] are produced either by mutation to or towards A_1 type action, or by loss of Spm from some cells late in ^{plant} ~~development~~ [^]. No large pale pigmented sectors usually appear in them. Also, the number and location of Spm is constant in various parts of a single plant. However, on testcross ears of these plants, the ratio of pale to variegated kernels deviates markedly in favor of the pale class. In the progeny

on such cases

derived from the variegated class of kernels, many plant may have
 either two or more Spm elements in them or one Spm at a new location
 in the chromosome complement in comparison to the location it occupied
 in the parent plant.

If the Spm in a plant does not undergo frequent transposition

early in development ^{of the plant} nor during development of the sporogenous or spore
 this also may be detected. ^{similar to that just described.}
 cells, the appearance of the plant is ~~quite uniform~~. With states

5719A-1 and 5718 of a_1^{m-1} , small pigmented streaks produced by mutation

to or towards A_1 type action appear in a non-pigmented background. On

the testcross ears of these plants, ^{however,} the ratio of pale to variegated

kernels approaches 1 : 1, the deviation in favor of the pale class being
 small. Also, in the progeny of these plants, few cases of transposition

of Spm are detected. ^{On some tests,} ~~In some cases,~~ the rate of transposition of Spm
^{may appear to be}

in a plant ^{is} low, when this is judged not only from the appearance of

the plant ^{itself} but also from the number of cases of transposition of it ~~encoun~~

encountered in progeny plants ^{kernels on the} derived from ^{produced by the plant.} its testcross ear. However,

when judged ^{due to} ~~from function of~~ ^{by the constitution in} its pollen grains, the rate of transposition

may be much greater, ^{Examples of this were} ~~and such cases have been~~ found. The difference

in ^{the} proportion of female gametes that carry a transposed Spm element

to male gametes having such, may reflect the delay in time of occurrence

of transposition of Spm that is characteristic of the particular Spm
~~present in the plant.~~
~~under study,~~ ^{may} the cells in the tassel arising ^{later in development} ~~rather~~ than those in the
 1
 ear.

Progeny test 17, figure 2

Examples of transposition of Spm, previously discussed, and those
 that will be discussed in the future, should be reviewed keeping in
 mind the conditions associated with it that have been outlined in the
 preceeding paragraphs. In continuing examination of transposition
 of Spm, the progeny of a plant having Spm/in chromosome 6 will be
 at another site
 discussed. The presence of Spm at this site was first detected ^{from}
 the ratio of kernel types on an ear of a plant (6704B-4, see table 18)
 carrying state 5996-4 a_1^{m-1} and Sh_2 in one chromosome 3 and a_1 and Sh_2
 in its homologues, when an ear of this plant had been used in a cross
 with the tester plant, 6678, whose constitution is given in table 19.
 The phenotypes of the kernels on the resulting ear indicated that one
 Spm was present in the ear-bearing plant and that it was carried in its
^{with Y}
~~Y-bearing~~ chromosome 6. This is shown in line 1 of table 45.
 To investigate further the behavior of this Spm, variegated kernels
 in the Y class were selected from this ear and sown in the summer
 of 1955 under culture number 6885. In culture 6885A, 15 plants were
 derived from kernels that had received state 5996-4 a_1^{m-1} from the female

parent and in 6885B, the plants had received a_1 from the female parent and state 5719A-1 from the male parent. All 24 plants were variegated. Testcross ears were obtained from 22 of these 24 plants. In 21 of them, 1 Spm was present and it was linked with Y in 20 of these plants, as shown in table 45. In one of these 20 plants, plant B-8, there was a marked deficiency in the y bearing class of kernels but the reason for this was not determined. It was obvious, nevertheless, that the Spm in it was carried in the Y bearing chromosome 6. Excepting plant B-8, the ratio of the pale class to the variegated class of kernels on the testcross ears of these plants indicated that the Spm in ~~them~~^{each} did not undergo frequent transposition late in development. In one plant, B-8, the single Spm element in it was not linked with Y. In the remaining plant,, B-9, table 45, two Spm elements were present and one of them was linked with Y.